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INITIAL STAGE

1. In the initial stage of the construction of an industrial building, the section of the ministry to which the future plant will be subordinated, prepares an outline (in accordance with the Five-Year Plan approved by the Government) of the classification of the plant and its production capacity. It then enters into an agreement with the planning bureau of the ministry for the planning of the plant. Subsequently, the section of the responsible ministry sets up a construction administration for the plant and transfers the functions of supervising its planning and building to that administration.

PLANNING STAGE

2. The first step in the planning stage is the preparation of an industrial assignment (formerly called a preliminary draft) by the drafting bureau. This draft consists of:

(a) A description of the technological process.
(b) A statement of the economic basis.
(c) A general plan.
(d) Designs of the main buildings.
(e) The approximate cost of the plant.

The industrial assignment must be approved by the technical council of the ministry.

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3. The second step is the preparation of the technical draft which is prepared by the same drafting bureau. The technical draft consists of:

(a) Blueprints showing the disposition of equipment, with explanatory memoranda.
(b) Blueprints of buildings and installations, with explanatory memoranda, and statistical estimates.
(c) A general plan, with railroad lines and roads.
(d) Blueprints of the water system, sewage system, heating system, ventilation, and electrical installations.
e. A complete estimate of the cost of construction of the plant.

Occasionally some of this work is contracted to special bureaus of design (e g the sprinkler system, a transformer substation).

4. This draft must be checked and approved in its entirety by the technical coundil of the ministry. The building section of the draft must be approved by the Scientific-Technical Council (N T S) of the Ministry of Construction. Estimates must be okayed by the special estimates commission of the Ministry of Construction. In addition to the above, separate parts of the draft are subject to the approval of: the oblast and city engineer; the medical department of the Ministry of Health; the fire inspector's office, etc.

5. The working drafts are drawn by the same planning bureau or the construction trust.

CONSTRUCTION

6. After the technical draft has been approved, the construction administration of the plant negotiates contracts with special trusts for construction work, for the installation of the water system, heating system, ventilation, etc. The cost of the work has already been fixed in the approved estimate.

7. The construction administration supervises the construction and the performance of separate contractors, pays their bills for completed work, and gives its final approval.

8. In addition, the administration prepares annual financial estimates and submits requisitions for building materials. The permit that it receives for purchases of materials are passed on to the trusts for purchasing. All labor is paid directly by the trusts.

INSTALLATION OF EQUIPMENT

9. The equipment in the plant is installed partly by the personnel of the construction administration and partly by the contractors who supply the equipment. After the installation is finished, the plant is officially opened for operation; all the personnel of the construction administration go to work in the plant, and the director of the administration usually obtains the post of director of the plant.

BUILDING MATERIALS AND THEIR USES IN CONSTRUCTION

10. Steel - During the first Five-Year Plan, steel was used on rare occasions and by special authorization. Later on, it was used in shops where danger of fire existed and there was much loading by cranes.

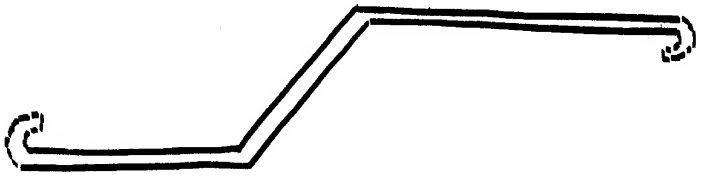
11. The German methods of planning and work, which formerly were in use, were superceded by US methods prior to World War II. A special plant producing structural steel was built in the Urals where, for the first time, steel was perforated by means of a multiple automatic punch.

12. During this period [1934-1941] pneumatic supports made their appearance (pneumatic hammers had been long in use), and so did cranes, which were called "Derik" (copy of US-type derricks). A special study was made of the US method of building skyscrapers and this method was adopted in the construction of the "Palace of Soviets" in Moscow. (During World War II all of the structural steel installations of the "Palace of Soviets" were dismantled and remelted). The basic permissible tension on steel is 1400 kilograms per square centimeter, which corresponds exactly to the US standard of 20,000 lbs. per square inch. Welding was widely employed during the last days prior to World War II. Electrical arc welding was mostly used. Automatic tools for welding were in the process of being worked out and had not yet been put into industrial use. Arc welding was done solely by hand.

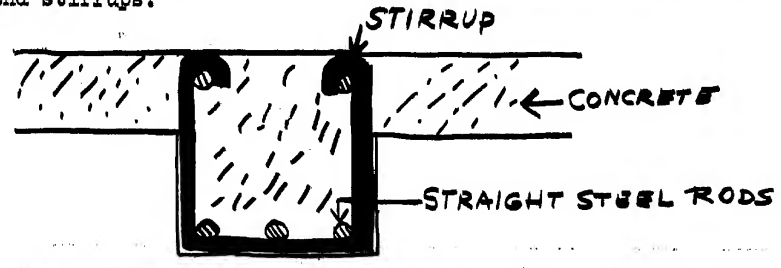
13. Small steel parts, which were so widely used in the US, namely; steel-sash fenestra, steel panels, steel doors, Q-floor steel deck, unistreets, steel joists, inserts, etc, were non-existent in the USSR. Steel windows were forbidden. Although small-profile steel was listed, it was almost unobtainable, because the steel plants preferred to roll heavy-profile steel in order to overfulfill their annual plan.

14. Steel-Concrete (formerly ferro-concrete) - During the first Five-Year Plan steel concrete (reinforced concrete) was substituted for steel structures in non-fireproof shops. In other shops, steel concrete was used for columns, and girders. Later (1934 and on) it became more widely used. The Soviet methods of planning and their technical standards are close to the German standards and differ sharply from US methods. In planning, the principal attention was devoted to the economy of materials regardless of the increase in labor involved.

15. Only plain or smooth "reinforcing bars" were used. There were no "deformed bars". In connection with this, all of the reinforcing bars had hooks bent at each end. As a rule every building trust had a "building yard" where the reinforcing bars were usually bent.



The minimum size of the bars in use was 6 mm (1/4"). In the US the minimum size of bars is 3/8". (Permissible stress in the USSR was 1200 kilograms per square centimeter [17,000 pounds per square inch]. The minimum percentage of reinforcement is half of that in the US. Shear stress is borne mainly by bent bars and stirrups.



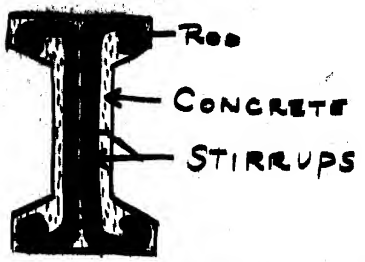
(In the US a part of shear stress is borne by concrete). Stirrups were obligatory along the entire length of a girder. This provides a greater safety factor for shearing than obtained in the US, but it requires more labor

16. Cement was of medium quality but very variable. Therefore, the use of concrete of high durability was difficult to achieve. Usually, concrete of ultimate compression stress of 110 kilograms per square centimeter (1600 pounds per square inch) on the 28th day, was used. Concrete of 180 kilograms per square centimeter compression stress was used less frequently. Concrete of 210 kilograms per square centimeter (3000 pounds per square inch) compression stress, which is in general use in the US, was used only on rare occasions in the USSR. An example was; the foundation of the "Palace of Soviets" (A special concrete plant was built for that purpose). The amount of cement used for hard concrete was 250 kilograms per cubic meter. Since the USSR had no ready mixed concrete, aggregates were usually delivered to the construction site in the form of separate unmixed sand and separate gravel. It was difficult to obtain a good granulometric (relationship of sand, gravel, cement and water) composition of aggregates.

17. The quality of concrete suffered considerably from insufficient mixing time. If the number of mixings exceeded 120 in eight hours, workmen received bonuses. Concrete of disastrously poor quality was obtained by "Stakhanovite methods", when the number of mixings reach 500 per eight hours, ie concrete was dumped out of the mixer immediately after the materials had been poured into it. Vibrators were seldom used.

18. Determination of stress and moments in rigid frame constructions of reinforced concrete was done very carefully by exact methods. The use of methods of approximation so common in the US was not recommended. Before World War II new standards of planning were issued, which were based on the estimate of ultimate stresses.

19. During the first Five-Year Plan "sectional ferro-concrete" (reinforced concrete) was widely used, i e concrete columns, girders, and slabs were made in advance at "construction yards" and assembled at the construction site, (like US LITH-I-BAR, Holland, Michigan).



The manufacture of ready-made concrete products, however, did not run smoothly, and gradually this type of construction was used less and less frequently, except for light slabs.

20. Wooden Structures - During the first Five-Year Plan, wooden structures were very much in use. They were even used for shops where danger of fire existed (such as boiler houses, small forging shops, etc). During the second Five-Year Plan the greater part of the structures were burnt down, rotted or caved in and were replaced by new concrete buildings. The quality of wood was very poor. Green, damp, wood fresh from forests and in poor condition was used. Later on, the use of wood was limited but it still played a large part in building; namely;

(a) Wooden trusses and girders (fastened with bolts, rings, and nails) for mechanical shops, warehouses, and other auxiliary-type buildings.
(b) Wooden roofs (under Rubberoid - a tar paper with less fibre than US tar paper).

(c). Wooden partitions.
(d). Floors and ceilings.
(e). Windows, doors, etc.

Permissible tensions correspond approximately to those in the US. Since the quality of the wood was poor (green, damp, and knotty) wooden structures had a very short life.

21. Walls - The basic material used for walls is bricks. During the first Five-Year Plan the mortar for laying bricks was made without cement (lime to which trass /a form of volcanic ash/ and puzzolana were added). Later on, a solution 1:2:12 cement-lime and sand were permitted. Still later slag cement blocks were used. Various slabs, asbestos-panel, fenestra-panels, etc. which are widespread in the US were not used. Partitions were usually made of wood and plastered, or of fibrolite (panels of wood shavings in magnesium-oxychloride cement).

22. Roofs - Industrial buildings with flat roofs and with a slope of not more than 1:10 were covered with Rubberoid over a concrete panel or wooden sheathing. The latter, as a rule, leaked. During the first Five-Year Plan, peat was used as heat-isolator. Since during construction it was impossible to escape rain altogether, the peat became very wet and most of the roofing rotted and was destroyed by a fungus (merilius lacrimus). In time, the use of friable peat was given up, and pressed peat blocks began to be used instead. In hot shops, where heat-isolation was not required, corrugated iron, and later corrugated asbestos plates were used.

23. Heated buildings with the roof slanting 1:3 or more were usually covered with Eternite (slabs made of a mixture of cement and asbestos, measuring 12" x 12") over wooden sheathing.

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